North Coast Watershed Assessment Program

DRAFT

# Mattole Watershed Synthesis Report

*The mission of the North Coast Watershed Assessment Program is to conserve and improve California's north coast anadromous salmonid populations by conducting, in cooperation with public and private landowners, systematic multi-scale assessments of watershed conditions to determine factors affecting salmonid production and recommend measures for watershed improvements.*

**Public Review Draft - March 22, 2002**

# Mattole Estuary

## *Introduction*

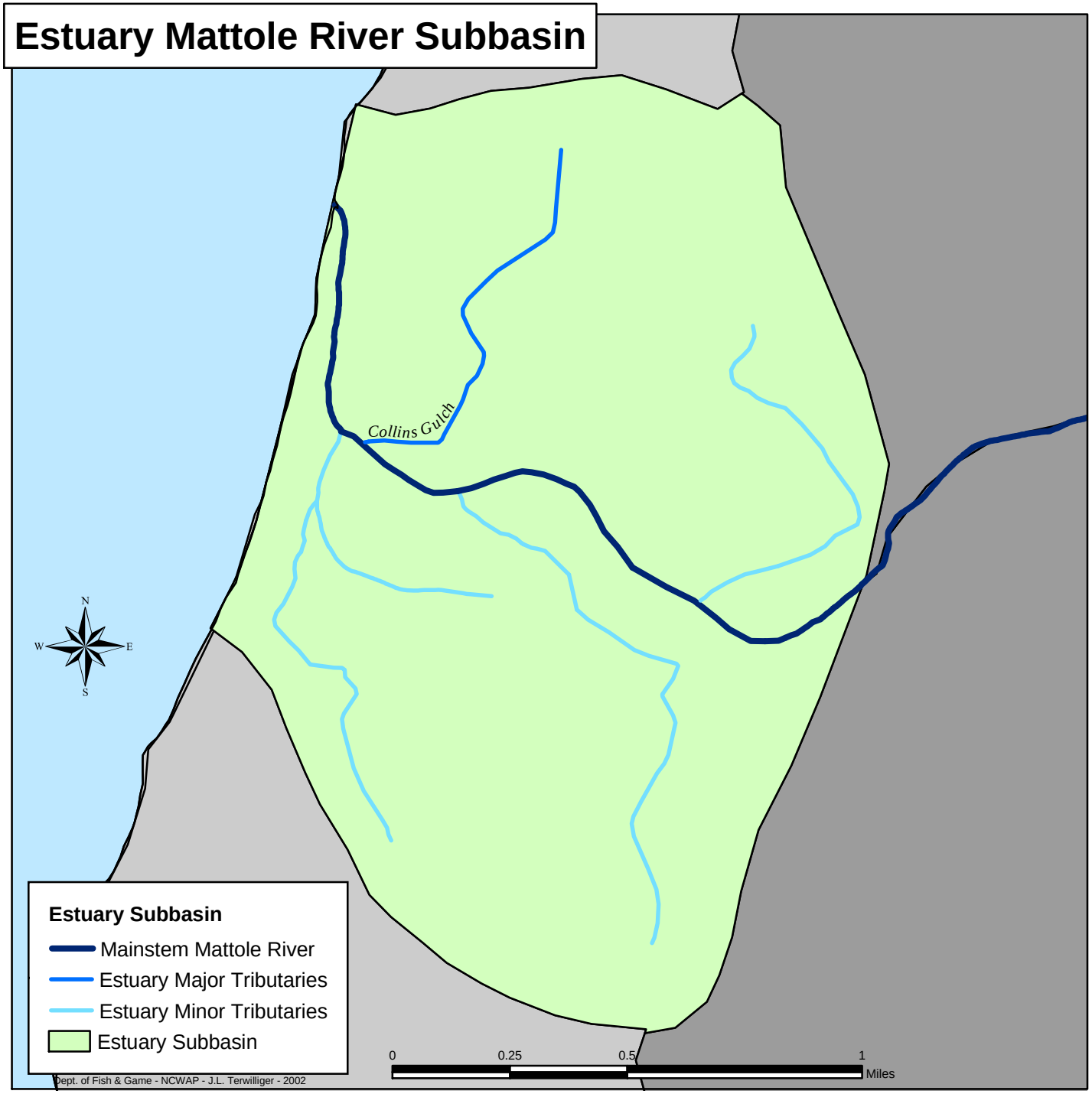
Estuaries are critical habitats for all anadromous salmonids. Estuaries are the connection between freshwater and marine environments through which salmonids pass as juveniles during seaward migrations and as adults to gain access to their native rivers during spawning migrations. Estuaries are also recognized as valuable salmonid nursery areas because they provide abundant food supplies, diverse habitat and offer protection from predators. Fish that utilize estuaries for an important part of their life cycle, such as salmonids, are referred to as estuarine-dependent.

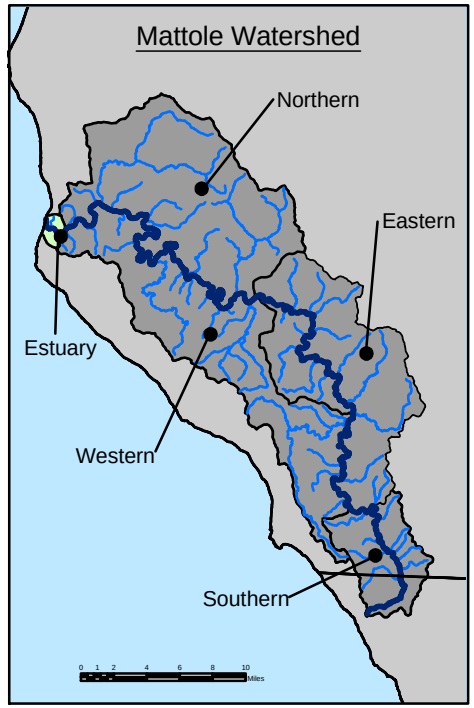
During seaward migrations, all juvenile chinook salmon, coho and steelhead utilize at least a brief estuarine residence while they undergo physiological adaptations to salt water and imprint on their natal stream. Juvenile salmonids may also extend their estuarine residency to utilize the sheltered and food rich environment for several months or a year before entering the ocean. Studies have revealed that juvenile salmonids utilizing estuaries for three months or more return to their natal stream at a higher rate than non-estuarine reared siblings (Riemers 1976, Nicholas and Hankin ). Estuarine reared salmonids may be at an advantage because they enter the ocean at a larger size or during more favorable conditions. Entering the ocean at a larger size may be advantageous by allowing juvenile salmonids to avoid predation or increasing the amount of prey items that can be used for food. Additionally, entering the ocean in mid-summer to early fall may increase survival if ocean conditions are unfavorable in the spring and early summer.

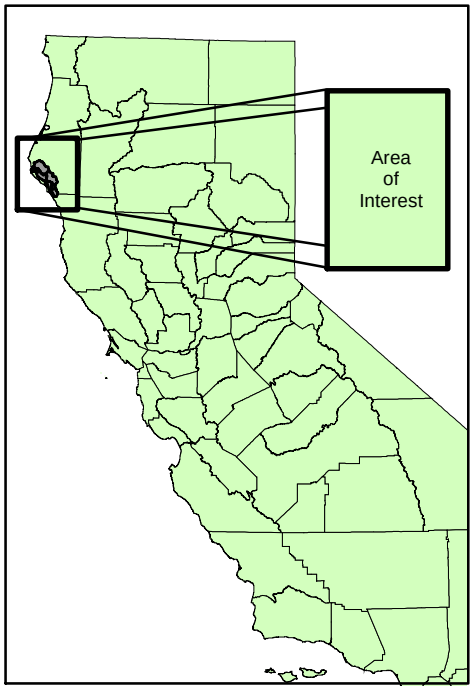
Estuarine rearing is a strategy that adds diversity to juvenile salmonid life history patterns and increases the odds for survival of a species encountering a wide range of environmental conditions in both the freshwater and marine environments. Additionally, an extended estuarine residency may be especially beneficial for salmonids from rivers where low summer flows or warm water temperatures severely limit summer rearing habitat.

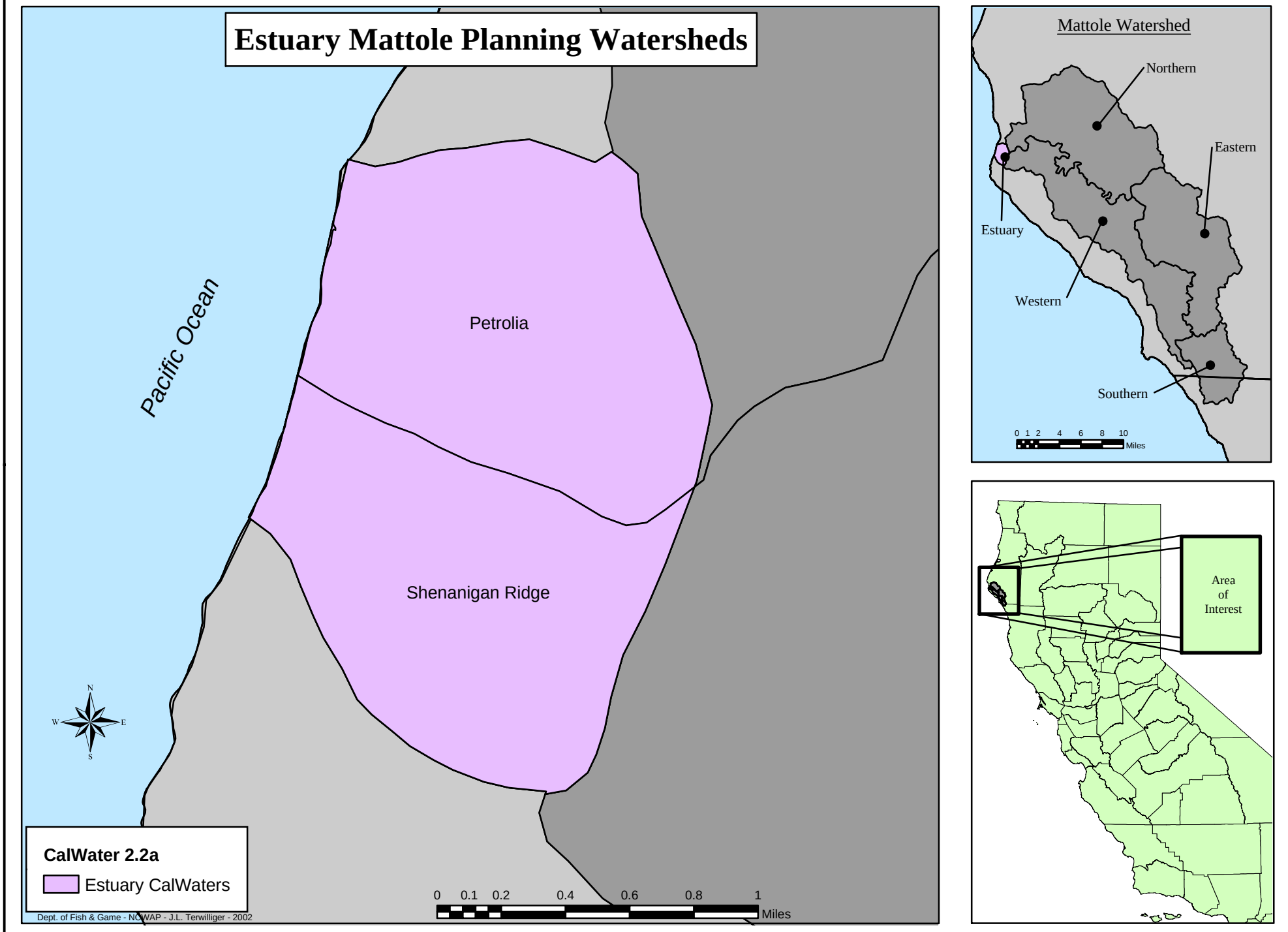
High levels of filling with sediment transported from the upper watershed through periodic flooding has reduced the Mattole River estuary volume and altered the physical and biologic function of estuarine ecosystem and adjacent wetlands. These impacts include elevated summer water temperatures. This present highly-impacted state of the estuarine habitat is likely limiting the production of salmonids in the Mattole River. In fact, extensive studies, led by Humboldt State University from 1985-92, found that chinook juveniles were suffering lethal impacts during summer rearing in the estuary. In response, the Mattole Salmon Group initiated a rescue trapping and rearing program which has had limited success  Long term watershed scale strategies are needed to improve the estuarine habitat, and efforts will require private landowner and local stakeholders cooperation. The Mattole dune system is unique in that the aggressive and introduced European beachgrass, A*mmophila arenaria*, has not yet encroached on the Mattole dunes as it has on most coastal dunes north of San Francisco. The estuary is probably the most well studied subbasin within the Mattole.

# Estuary Mattole River Subbasin




Estuary Mattole Planning Watersheds
Pacific Ocean
Petrolia
Shenanigan Ridge
N
W
E
S
CalWater 2.2a
Estuary CalWaters
0 0.1 0.2 0.4 0.6 0.8 1
Miles
Dept. of Fish & Game - NCWAP - J.L. Terwilliger - 2002
Mattole Watershed
Northern
Eastern
Estuary
Western
Southern
0 1 2 4 6 8 10
Miles
Area
of
Interest

## Climate

In the Estuary subbasin, air temperatures average 55° F and ranges from 40° to 65° F. Rainfall in this area averages 60 inches per year. Summer fog is usually present here although fog is not a common climatic feature of the Mattole basin.

## Hydrology

The Estuary subbasin contains small sections of the Petrolia and Shennanigan Ridge CalWater 2.2a Planning Watersheds (Calwater Units) (see map on previous page). There are no perennial tributaries in this subbasin (see map on previous page).

## Geology

The bedrock underlying the uplands above the Estuary consists of the Franciscan Coastal terrane. In the Estuary subbasin the Franciscan is dominated by mélange with a far smaller area underlain by intact sandstone and argillite units. The strength of the mélange is variable, forming a soft to moderate topography of rolling hillsides, moderate slopes and rounded crests. The small area overlooking the coast north of the Mattole River underlain by intact sandstone and argillite units forms a hard terrain with a greater proportion of steep slopes. The distribution of these terrains for the entire Mattole Watershed is presented on maps within the *Mattole Watershed Profile – Geology* section of this report.

The Estuary of the Mattole River divides this subbasin roughly in half, and occupies a wide active channel within a relatively wide valley. The active channel is underlain by Quaternary stream channel deposits whereas the balance of the valley floor is underlain by Quaternary alluvium and river terraces.

The Mendocino Triple Junction, where the Gorda, North American, and Pacific geologic plates meet, occurs in the vicinity of the Eustuary, making the Mattole River basin as a whole one of the most tectonically active in California.

Much of the moderate terrain south of the Mattole River is underlain by a large dormant landslide complex. A number of dormant rockslides overly the locally steep slopes on the hard terrain north of the Mattole River near the river mouth while a portion of the hard terrain and the adjacent soft terrain is underlain by a dormant composite slide. No active landslides were mapped in this subbasin. Debris slide slopes are restricted to small elongate areas associated with locally steep slopes within the hard and moderate terrain. Landslide occurrences on the three terrains are presented on maps within the *Mattole Watershed Profile – Geology* section of this report. As a result of these relationships, the uplands south of the Estuary are interpreted as havng predominantly moderate landslide potential, whereas north of the Eustuary the uplands are assessed as having predominantly high to very high landslide potential

## Vegetation

The vegetation of the Estuary subbasin is very diverse. The Mattole Restoration Council's Elements of Recovery (1989), identifies nine distinct plant communities. Willows and red alder are found along past and present river channels. Lower floodplains contain grasses with scattered willows and coyote brush. Grasslands predominate on higher floodplains and hillslopes which have been cleared, cut, or grazed. Hillslope gullies, washes, and ravines contain coniferous/deciduous forest, mostly second and third growth coniferous forests with large stands of mature tanoak. Dune areas contain beach layia, a federally listed endangered plant species.

## Land Use

Human habitation of the Estuary area goes back hundreds of years as evidenced by shell middens on the beach south of the Estuary. The native inhabitants hunted, fished, and made use of the diverse flora and fauna of the area. Euro-Americans arrived in the 1850s, bringing pasture and row crops to the river bottom flats, and sheep and cattle grazing to the surrounding hillsides. The largest land-use change occurred in 1970, with the creation of King Range National Conservation Area, managed by the Bureau of Land Management. Although limited grazing still occurs, BLM currently manages the estuary area for conservation and recreation. The BLM maintains a public campground and trailhead at the mouth of the river for the 25-mile "Lost Coast Trail" from the Mattole River to Shelter Cove.

## Fluvial Geomorphology

The Mattole Estuary is characterized by a lowest gradients and widest channel, occupying a relatively wide valley. The system of gravel bars along the Lower Mattole has remained relatively constant between the years 1984 to 2000. Minor changes have been observed chiefly with respect to the location and development of vegetated bars. Between 1942 and 1965 the Mattole Estuary was dramatically widened and large areas of vegetation were lost. However, relative to the 1965 photo in Figure 18, the 1984 and 2000 photos (WAC-84C, 21-165 and WAC-00-CA, 7-195) show (1) a progressive increase in vegetation along the south bank, (2) a decrease in the width of the active channel, (3) smaller areas of braided stream channel, and (4) a shift of the active channel to the north bank. In addition, at the dates the 1984 and 2000 photos where taken (May 6, 1984 and March 31, 2000) the mouth of the Mattole River was open.

***Figure 17: The Mattole River Estuary in 1942.***

*Riparian vegetation appears as dark patches and strips on the light gravel bar. The mouth was open when this photo was taken. Although the flow was not low, the wetted channel is narrow in some places. Photo provided by the Mattole Restoration Council.*

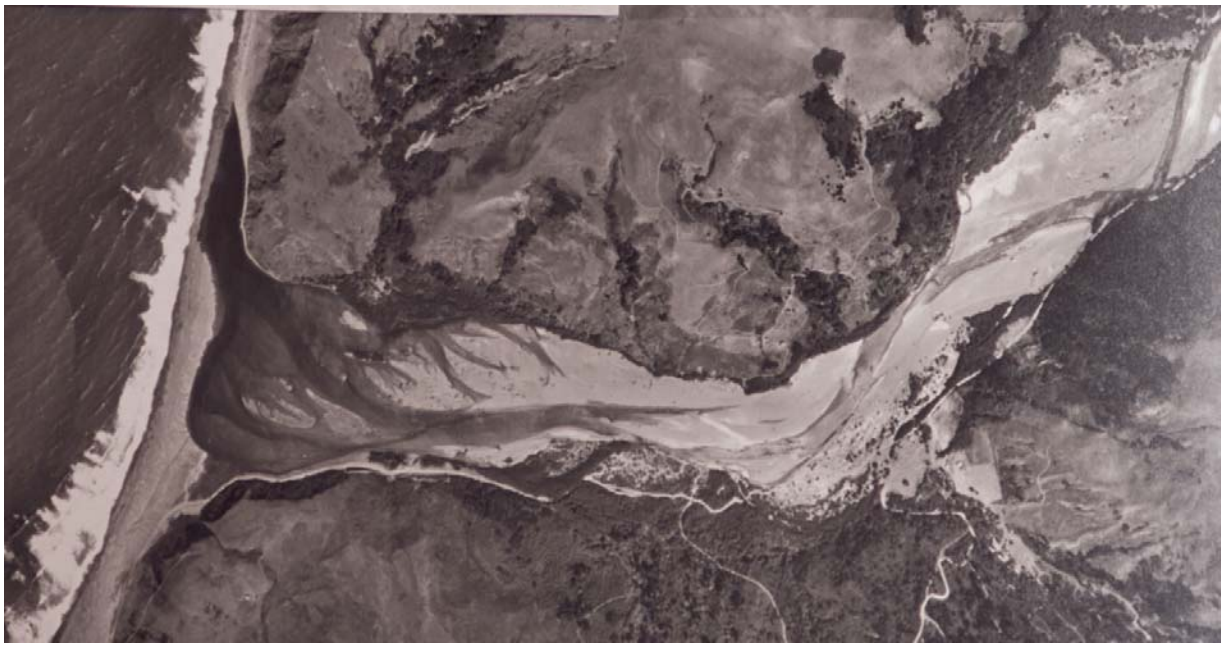


***Figure 18: The Mattole River Estuary in 1965.***

*Riparian vegetation is rare along the wetted channel. At the time of this photo, the mouth was closed and some relative depths of the lagoon are evident. The wetted channel is wide and braided. Photo provided by the Mattole Restoration Council.*

## Aquatic/Riparian Conditions

Field observations conducted by Humboldt State University students from 1985-1992 and ongoing field observations indicate lack of pools, lack of in-stream structures for cover and lack of riparian canopy around the Estuary. These factors contribute to elevated water temperatures. Additionally, lack of depth and escape cover for juveniles and adults contributes to possible natural-predator predation problems. There is not enough data to determine whether water chemistry is a limiting factor in the Estuary.

## Fish Habitat Relationship

Sediment and temperature impacts are currently deleterious to summer rearing salmonid populations. Present conditions are a product of upstream natural processes and human land uses. Although summer water temperatures are currently documented to be higher than fully suitable EMDS values, there is not enough information over time to understand temperature trends. Because juvenile chinook over-summer in the estuary, they are affected by temperature to a greater degree than steelhead or coho. The life cycle of young chinook historically included a summer rearing phase in lagoon or estuarine habitats. Juveniles typically entered the esturary in spring and left for the sea in autumn. In response to the estuarine conditions for rearing chinook juveniles, the Mattole Salmon Group has conducted rescue rearing operations since 1994. The project traps down migrating chinook juveniles at river mile 3.0 adjacent to summer rearing tanks at Mill Creek, and releases them in the fall for out-migration. This project needs to continue as an assessment program to evaluate its efficacy by marking all released fish.

## Fish History and Status

According to local historic accounts, historic levels of salmonid populations were very abundant. There are many long-time resident accounts of excellent salmon fishing opportunities. A much-anticipated annual event was the estuary/lagoon opening, usually in October. Local residents would camp around the estuary and catch great numbers of salmon as the first of the runs migrated upstream. Populations decreased to the point that masters thesis studies by Humboldt State University students document no chinook over-summering in the estuary in 1988. Chinook had been found the previous three years. Dive observations since then indicate the presence of juvenile steelhead but not chinook.

## Subbasin Trends

The trends for several factors within the Estuary can be summarized as follows. The size and extent of the riparian vegetation will continue to be dependent on natural conditions since it is largely within Bureau of Land Management (BLM) ownership and not subject to management activities. The main road in the estuary area is along the valley floor. It has a rocked road surface, an inside ditch and culverted crossings of tributary streams, and is used year-round. This road may deposit some fines into the estuary system during wet weather, but is on level ground with minimal road gradient. The number of roads is not expected to increase because of BLM's current land-use objectives.

Stream temperature data in 1999 indicated that peak maximum temperatures exceeded 73º at the river mouth and 78º one mile upstream. Data presented by the Department of Water Resources in their report evaluated temperatures from 1996 to 1999 and 2001, not long enough to establish a trend in water temperatures.

There is no data on suspended sediment levels within the estuary. Gravel bars remained stable from 1984-2000. Analysis of previous years has not been undertaken to see if this is a continuing trend. Both the 1955 and 1964 floods were one-hundred year return flood events while all other major storm events in the years 1951-2000, the period of record for the Petrolia stream gauge, hover around the ten year flood event level.

Current estimated populations of chinook salmon and coho salmon throughout the Mattole Basin are low compared to United States Fish and Wildlife Service (USFWS) estimated populations in 1960. Outmigrant trapping of steelhead trout appears to indicate that their population is closer to the 1960 USFWS population estimate. However, not enough quantitative data on any salmonid species exists to establish clear trends on a subbasin basis.

## *Estuary Subbasin Issues*

- Sediment and temperature impacts are currently deleterious to summer rearing salmonid populations. Present conditions are a product of upstream natural processes and human land uses. Although summer water temperatures are currently documented to be higher than fully suitable EMDS values, there is not enough information over time to understand temperature trends. Because juvenile chinook over-summer in the estuary, they are affected by temperature to a greater degree than steelhead or coho.

- Field observations during extensive academic studies and ongoing field observations by the DFG and the Mattole Salmon Group indicate that pool habitat, escape and ambush cover, water depth, substrate embeddedness, and water temperature are likely unsuitable for salmonids.

- The life cycle of young chinook historically included a summer rearing phase in lagoon or estuarine habitats. Juveniles typically entered the estuary in spring and left for the sea in autumn. In response to the unsuitable estuarine conditions for rearing chinook juveniles, the Mattole Salmon Group has conducted rescue rearing operations since 1994. The project traps down migrating chinook juveniles at river mile 3.0 adjacent to summer rearing tanks at Mill Creek, and releases them in the fall for out-migration. This project needs to continue as an assessment program to evaluate its efficacy by marking all released fish.

- The bedrock underlying the uplands above the Estuary is dominated by mélange and much of the uplands above the Estuary are underlain by large dormant landslides. No active landslides were mapped in this subbasin. The Estuary uplands generally have a moderate to very high landslide potential (CGS, 2002).

- Between 1942 and 1965 the Mattole Estuary widened, and areas of vegetation were lost, however, trends from 1984 to 2000 show: a progressive increase in vegetation along the south bank; a decrease in the width of the active channel; and smaller areas of braided stream channel. The system of gravel bars along the Lower Mattole has remained relatively constant over the last 15 years, with minor changes observed chiefly with respect to the location and development of vegetated bars (CGS, 2002).

## *Estuary Subbasin Issue Synthesis*

### Working Hypothesis 1:

**THE PRESENT STATE OF ESTUARINE HABITAT IS LIMITING THE PRODUCTION OF SALMONIDS, ESPECIALLY CHINOOK, IN THE MATTOLE RIVER.**

### Supportive Findings:

- Estuaries provide critical habitat for all anadromous salmonid species.

- Sediment from upstream has been delivered by storm events and has accumulated in the low gradient estuarine channel.

- Sources of upstream sediment include natural background erosion and additional erosion from land use.

- Water temperatures in the estuary, as a result of warming effects upstream, periodically exceed a level that is fully supportive of salmonids (Dynamics of Recovery 1995).

## Recommendations:

1. Continue the chinook juvenile rescue rearing and fish tagging program and incorporate an effectiveness monitoring program.

2. Institute a basin-wide road/erosion assessment, treatment and erosion control program to reduce sediment yield where possible. Follow land use guidelines such as Department of Mines and Geology Note 50 (Department of Conservation, 1997; see Appendix X).

3. Maintain and enhance existing riparian cover. Use cost share programs and conservation easements as appropriate.

4. Monitor summer water and air temperatures on a continuous 24-hour basis to detect long-range trends and short-term affects on the aquatic / riparian community.

5. Examine the role of the mainstem Mattole River in elevated estuarine water temperatures.